

U.S. Serial No. 10/597,840
Amendment Dated December 16, 2008

REMARKS

Claims 1, 2 and 4-16 are pending in this application. Claims 1, 2 and 4-8 are amended, claim 3 is canceled, and new claims 9-16 are added. Claims 1, 2 and 4-8 are amended to conform to U.S. claim format, for example, by eliminating figure reference numbers.

No new matter is added to the application by this Amendment. Support for the features added to claim 1 can be found in paragraphs [0001], [0007] and [0011] of U.S. Patent Publication 2007/0158256 (hereinafter "the 256 publication") for the present application. The features added to claim 5 find support in paragraph [0026] of the 256 publication. New claims 9-16 find support in claims 9-16 in the corrected version of International Publication No. WO 2005/082499 (published on October 11, 2007) from which the present application claims priority to. For the convenience of the Patent Office, a copy of the corrected version of WO 2005/082499 is attached herewith. Additionally, the Applicants submit, for the convenience of the Patent Office, that new claims 9-16 also find support in paragraphs [0018], [0019] and [0027]-[0031] of the 256 publication.

Reconsideration of the application is respectfully requested.

I. Rejection Under 35 U.S.C. §102

Claims 1-5 were rejected under 35 U.S.C. §102(b) as allegedly being anticipated by U.S. Patent No. 5,958,243 to Lawrence et al. (hereinafter "Lawrence"). The rejection is respectfully traversed.

The Patent Office alleges that Lawrence teaches each and every feature recited in claims 1-5. Applicants respectfully disagree with this allegation.

U.S. Serial No. 10/597,840
Amendment Dated December 16, 2008

claim 1.

Additionally, the backwashing periods of Lawrence involve flow direction reversal of bulk fluid volumes (for example the fluid in the permeate chamber 5). Lawrence teaches away from the controller configured to operate the shut-off valve at a high frequency of claim 1 because the pressure buildup according to Lawrence requires the (bulk) fluid present in the pipe segment comprising valve 14 to be periodically put into motion which adds to the inertia of the system.

Because the features of independent claim 1 are neither taught nor suggested by Lawrence, Lawrence cannot anticipate, and would not have rendered obvious, the features specifically defined in claim 1 and its dependent claims.

For at least these reasons, claims 1, 2, 4 and 5 are patentably distinct from and/or non-obvious in view of Lawrence. Reconsideration and withdrawal of the rejections of the claims under 35 U.S.C. §102(b) are respectfully requested.

II. Rejection Under 35 U.S.C. §103

Claims 6-8 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Lawrence in view of U.S. Patent No. 4,749,476 to Storkebaum et al. (hereinafter "Storkebaum"). The rejection is respectfully traversed.

Storkebaum does not remedy the deficiencies of Lawrence as described above with respect to claim 1, from which claims 6-8 depend. Claims 7 and 8 either directly or indirectly depend from claim 6.

The Patent Office acknowledges that Lawrence fails to teach or suggest the feature, a

U.S. Serial No. 10/597,840
Amendment Dated December 16, 2008

retentate circulation circuit, of claims 6 (see pages 4 and 5 of the Office Action). The Patent Office introduces Storkebaum as allegedly remedying these deficiencies of Lawrence. The Patent Office alleges that it would have been obvious to provide the system disclosed by Lawrence with a retentate circulation circuit as taught by Storkebaum in order to return the retained substance to the feed supply, if desired to do so. Applicants respectfully disagree with these allegations.

As discussed with respect to claim 1, Lawrence does not teach or suggest a controller adapted to operate the shut-off valve at a high frequency as required by claim 1. Storkebaum fails to remedy the deficiencies of Lawrence because Storkebaum does not teach or suggest operating a valve at a high frequency. Thus, neither Lawrence nor Storkebaum, taken singly or in combination, teaches or suggests a controller adapted to operate the shut-off valve at a high frequency as required by claim 1.

Because these features of independent claim 1 are not taught or suggested by Lawrence and Storkebaum, taken singly or in combination, these references would not have rendered the features of claim 1 obvious to one of ordinary skill in the art.

For at least these reasons, claims 6-8 are patentable over Lawrence and Storkebaum. Thus, withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

III. New Claims

Neither Lawrence nor Storkebaum, taken singly or in combination, teaches or suggests the required features of the apparatuses of new claims 9-14 or the methods of new claims 15 and 16.

For at least this reasons, new claim 9-16 are patentable over Lawrence and Storkebaum,

Page 10 of 12

Page 11 of 12

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

CORRECTED VERSION

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
9 September 2005 (09.09.2005)

PCT

(10) International Publication Number
WO 2005/082499 A1(51) International Patent Classification:
B01D 61/14 (2006.01) B01D 65/08 (2006.01)
B01D 65/02 (2006.01)(21) International Application Number:
PCT/NL2005/000098(22) International Filing Date:
10 February 2005 (10.02.2005)

(25) Filing Language: Dutch

(26) Publication Language: English

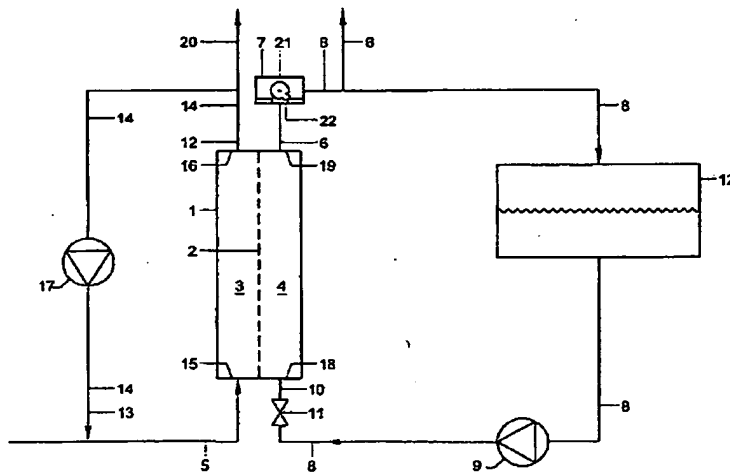
(30) Priority Data:
1025459 11 February 2004 (11.02.2004) NL(71) Applicant (for all designated States except US): FRIES-
LAND BRANDS B.V. [NL/NL]; Blankenstein 142,
NL-7943 PE Meppel (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): KROMPKAMP,
Jantje [NL/NL]; Amsterdamseweg 5, NL-6711 BE Ede
(NL). VAN DER PADT, Albert [NL/NL]; Latonalaan
56, NL-7321 EA Apeldoorn (NL). VAN DER VORST,
Cornelis, Petrus, Jacobus, Maria [NL/NL]; Laan van
Klarenbeek 35, NL-6824 JL Arnhem (NL).(74) Agent: WINCKELS, J.H.F.; Johan de Wittlaan 7,
NL-2517 JR Den Haag (NL).(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY,
TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU,
ZA, ZM, ZW.(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO,
SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,
GQ, GW, ML, MR, NE, SN, TD, TG).Published:
— with international search report

[Continued on next page]

(54) Title: APPARATUS AND METHOD FOR MICRO OR ULTRAFILTRATION



(57) Abstract: An apparatus provided with a micro or ultrafiltration filter, wherein the filter is provided with a filter housing having a retentate side and a permeate side, wherein the retentate side and the permeate side are separated from each other by filter material, wherein a fluid supply pipe is connected to the retentate side and a permeate discharge pipe to the permeate side, wherein, in the permeate discharge pipe, a shut-off valve operable at a high frequency is provided and wherein means are connected to the permeate side for increasing the pressure in the permeate side when the said shut-off valve is closed to a value which is higher than the pressure on the retentate side.

WO 2005/082499 A1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1041 1042 1043 1044 1045 1046 1047 1048 1049 1050 1051 1052 1053 1054 1055 1056 1057 1058 1059 1060 1061 1062 1063 1064 1065 1066 1067 1068 1069 1070 1071 1072 1073 1074 1075 1076 1077 1078 1079 1080 1081 1082 1083 1084 1085 1086 1087 1088 1089 1090 1091 1092 1093 1094 1095 1096 1097 1098 1099 1100 1101 1102 1103 1104 1105 1106 1107 1108 1109 1110 1111 1112 1113 1114 1115 1116 1117 1118 1119 1120 1121 1122 1123 1124 1125 1126 1127 1128 1129 1130 1131 1132 1133 1134 1135 1136 1137 1138 1139 1140 1141 1142 1143 1144 1145 1146 1147 1148 1149 1150 1151 1152 1153 1154 1155 1156 1157 1158 1159 1160 1161 1162 1163 1164 1165 1166 1167 1168 1169 1170 1171 1172 1173 1174 1175 1176 1177 1178 1179 1180 1181 1182 1183 1184 1185 1186 1187 1188 1189 1190 1191 1192 1193 1194 1195 1196 1197 1198 1199 1200 1201 1202 1203 1204 1205 1206 1207 1208 1209 1210 1211 1212 1213 1214 1215 1216 1217 1218 1219 1220 1221 1222 1223 1224 1225 1226 1227 1228 1229 1230 1231 1232 1233 1234 1235 1236 1237 1238 1239 1240 1241 1242 1243 1244 1245 1246 1247 1248 1249 1250 1251 1252 1253 1254 1255 1256 1257 1258 1259 1260 1261 1262 1263 1264 1265 1266 1267 1268 1269 1270 1271 1272 1273 1274 1275 1276 1277 1278 1279 1280 1281 1282 1283 1284 1285 1286 1287 1288 1289 1290 1291 1292 1293 1294 1295 1296 1297 1298 1299 1300 1301 1302 1303 1304 1305 1306 1307 1308 1309 1310 1311 1312 1313 1314 1315 1316 1317 1318 1319 1320 1321 1322 1323 1324 1325 1326 1327 1328 1329 1330 1331 1332 1333 1334 1335 1336 1337 1338 1339 1340 1341 1342 1343 1344 1345 1346 1347 1348 1349 1350 1351 1352 1353 1354 1355 1356 1357 1358 1359 1360 1361 1362 1363 1364 1365 1366 1367 1368 1369 1370 1371 1372 1373 1374 1375 1376 1377 1378 1379 1380 1381 1382 1383 1384 1385 1386 1387 1388 1389 1390 1391 1392 1393 1394 1395 1396 1397 1398 1399 1400 1401 1402 1403 1404 1405 1406 1407 1408 1409 1410 1411 1412 1413 1414 1415 1416 1417 1418 1419 1420 1421 1422 1423 1424 1425 1426 1427 1428 1429 1430 1431 1432 1433 1434 1435 1436 1437 1438 1439 1440 1441 1442 1443 1444 1445 1446 1447 1448 1449 1450 1451 1452 1453 1454 1455 1456 1457 1458 1459 1460 1461 1462 1463 1464 1465 1466 1467 1468 1469 1470 1471 1472 1473 1474 1475 1476 1477 1478 1479 1480 1481 1482 1483 1484 1485 1486 1487 1488 1489 1490 1491 1492 1493 1494 1495 1496 1497 1498 1499 1500 1501 1502 1503 1504 1505 1506 1507 1508 1509 1510 1511 1512 1513 1514 1515 1516 1517 1518 1519 1520 1521 1522 1523 1524 1525 1526 1527 1528 1529 1530 1531 1532 1533 1534 1535 1536 1537 1538 1539 1540 1541 1542 1543 1544 1545 1546 1547 1548 1549 1550 1551 1552 1553 1554 1555 1556 1557 1558 1559 1560 1561 1562 1563 1564 1565 1566 1567 1568 1569 1570 1571 1572 1573 1574 1575 1576 1577 1578 1579 1580 1581 1582 1583 1584 1585 1586 1587 1588 1589 1590 1591 1592 1593 1594 1595 1596 1597 1598 1599 1600 1601 1602 1603 1604 1605 1606 1607 1608 1609 1610 1611 1612 1613 1614 1615 1616 1617 1618 1619 1620 1621 1622 1623 1624 1625 1626 1627 1628 1629 1630 1631 1632 1633 1634 1635 1636 1637 1638 1639 1640 1641 1642 1643 1644 1645 1646 1647 1648 1649 1650 1651 1652 1653 1654 1655 1656 1657 1658 1659 1660 1661 1662 1663 1664 1665 1666 1667 1668 1669 1670 1671 1672 1673 1674 1675 1676 1677 1678 1679 1680 1681 1682 1683 1684 1685 1686 1687 1688 1689 1690 1691 1692 1693 1694 1695 1696 1697 1698 1699 1700 1701 1702 1703 1704 1705 1706 1707 1708 1709 1710 1711 1712 1713 1714 1715 1716 1717 1718 1719 1720 1721 1722 1723 1724 1725 1726 1727 1728 1729 1730 1731 1732 1733 1734 1735 1736 1737 1738 1739 1740 1741 1742 1743 1744 1745 1746 1747 1748 1749 1750 1751 1752 1753 1754 1755 1756 1757 1758 1759 1760 1761 1762 1763 1764 1765 1766 1767 1768 1769 1770 1771 1772 1773 1774 1775 1776 1777 1778 1779 1780 1781 1782 1783 1784 1785 1786 1787 1788 1789 1790 1791 1792 1793 1794 1795 1796 1797 1798 1799 1800 1801 1802 1803 1804 1805 1806 1807 1808 1809 1810 1811 1812 1813 1814 1815 1816 1817 1818 1819 1820 1821 1822 1823 1824 1825 1826 1827 1828 1829 1830 1831 1832 1833 1834 1835 1836 1837 1838 1839 1840 1841 1842 1843 1844 1845 1846 1847 1848 1849 1850 1851 1852 1853 1854 1855 1856 1857 1858 1859 1860 1861 1862 1863 1864 1865 1866 1867 1868 1869 1870 1871 1872 1873 1874 1875 1876 1877 1878 1879 1880 1881 1882 1883 1884 1885 1886 1887 1888 1889 1890 1891 1892 1893 1894 1895 1896 1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661

WO 2005/082499

PCT/NL2005/000098

Title: Apparatus and method for micro or ultrafiltration

The invention relates to an apparatus provided with a micro or ultrafiltration filter, where the filter is provided with a filter housing having a retentate side and a permeate side, where the retentate side and the permeate side are separated from each other by filter material, where a fluid supply pipe is connected to the retentate side and a permeate discharge pipe to the permeate side.

Such an apparatus is known from practice. Micro or ultrafiltration are filtration processes used to separate fluids on the basis of a difference in particle or molecule dimensions. For this purpose, filter material is used with a pore diameter of the order of magnitude of 0.1-10 micrometer (microfiltration) or with a MWCO (molecular weight cut off) of 1 kDa to about 200 kDa (ultrafiltration). In practice, such filter material is also referred to by the term filter membrane. Examples of applications are concentrating proteins in milk, removing microorganisms and clearing fruit juices and wine. Important process parameters for micro and ultrafiltration are the flux and the selectivity. The flux relates to the amount of fluid that permeates per time unit and per unit of filter material surface and is an indicator of the capacity of the process. The selectivity indicates the ratio of the concentration of two components to be separated in the permeate in relation to the starting fluid and is a measure of the efficiency of the separation step.

A problem of micro and ultrafiltration is that the filter material pollutes very rapidly; blocked components accumulate against and in the filter material and this adversely affects the flux and the selectivity of the process. It has already been proposed to clean the filter material by reversing the fluid flow in the filter material. In the literature, such an

WO 2005/082499

PCT/NL2005/000098

2

action is referred to by the term back pulsing. A description thereof is given in European patent application EP-A-0 588 348. The solution described in that publication is not suitable for high-frequency back pulsing. A high frequency is desired to keep the filter material as clean as possible. In addition, the back pulse needs to take as short a time as possible to adversely affect the capacity of the filtration process as little as possible. These objects are insufficiently achieved with the apparatus described in the European application. The invention contemplates an apparatus in which these objects are achieved.

10 For this purpose, according to the invention, the apparatus of the type described in the introduction is characterized in that in that a shut-off valve operable at a high frequency is provided in the permeate discharge pipe, while means are connected to the permeate side for increasing the pressure in the permeate side when the shut-off valve is closed to a value
15 higher than the pressure on the retentate side.

The means for increasing the pressure need to be designed such that the pressure on the permeate side increases very fast to above the pressure prevailing in the retentate side. This is because then, in a minimal period of time, the back pulse can be effected, after which the shut-off valve can be
20 opened again and the normal filtration process can take place again. Thus, the capacity of the filtration process is hardly adversely affected.

According to a further elaboration of the invention, a very rapid pressure build-up can be obtained with an apparatus in which the shut-off valve is designed to be opened and closed periodically, with the shut-off
25 valve being kept in a closed position so long that a higher pressure is built up on the permeate side than on the retentate side, such that a reversal of the fluid flow in the filter material occurs, while the means for increasing the pressure in the permeate side are designed such that, for the rest, a reversal of flow direction of fluid in pipes of the apparatus is prevented.
30 Because there no reversal of the flow direction of fluid volumes occurs in any

WO 2005/082499

PCT/NL2005/000098

3

of the pipes, the slowness in the system during the building up of the hydrostatic pressure on the permeate side will be minimal.

Such an apparatus may, for instance, be realized in that the means for increasing the pressure comprise at least one permeate circulation circuit which is, on the one side, connected, by an inlet, to the permeate discharge pipe at a point downstream of the shut-off valve and, on the other side, by an outlet, to the permeate side of the filter housing, while a permeate circulation pump is provided in the permeate circulation circuit.

In a thus designed apparatus, in an opened condition of the shut-off valve, permeate is pumped around through the permeate circulation circuit. As soon as the shut-off valve is in a closed position, the pressure will increase downstream of the permeate circulation pump, resulting in the pressure in the permeate side of the filter housing increasing. When the shut-off valve remains closed long enough, the pressure on the permeate side will become higher than on the retentate side and back pulsing will occur.

By suddenly closing the shut-off valve, pressure instability in the pipe system can occur, when could result in, for instance, water shock. In order to prevent this phenomenon, according to a further elaboration, it is particularly favorable if, upstream of the outlet of the permeate circulation circuit and downstream of the permeate circulation pump, a restriction is included in order to prevent a jerky pressure build-up.

In addition, in the permeate circulation circuit, a permeate buffer tank may be included for feeding the pump during the closed condition of the shut-off valve.

According to a further elaboration of the invention, it is particularly favorable if the fluid supply pipe is connected to a first end of the retentate side of the filter housing, while a retentate circulation circuit is provided, while an inlet of the retentate circulation circuit is connected to a second end of the retentate side of the filter housing, while an outlet of the

WO 2005/082499

PCT/NL2005/000098

4

retentate circulation circuit is connected to the fluid supply pipe, while a retentate circulation pump is provided in the retentate circulation circuit, while the first end is opposite the second end, such that, with a switched-on retentate circulation pump, a cross-flow along the filter material occurs.

5 Such a cross-flow results in a cleaning action of the filter material which, in combination with the above-described back pulsing, results in an improved selectivity and flux of the filter material.

According to a further elaboration of the invention, it is favorable if the outlet of the permeate circulation circuit is connected to a first end of
10 the permeate side of the filter housing, while the permeate discharge pipe is connected to a second end of the permeate side of the filter housing, while the first end is opposite the second end, such that, on the permeate side of the filter housing, a cross-flow along the filter material occurs, while the cross-flow on the retentate side has the same flow direction as the cross-flow
15 on the permeate side.

It has been found that, on the retentate side, under the influence of the cross-flow prevailing there, a pressure drop prevails in the filter housing viewed in the cross-flow direction. This therefore results in the pressure on the retentate side of the filter material not being equal over the whole
20 surface of the filter material. If there is an equal pressure everywhere on the permeate side of the filter material, the result will be that the pressure drop over the filter material viewed over the surface of the filter material varies. This in turn results in the flow rate through the filter material viewed over the surface of the filter material not being equal everywhere.
25 By now ensuring that the cross-flow on the retentate side has the same flow direction as the cross-flow on the permeate side, a substantially equal pressure drop can be effected over the whole surface of the filter material.

According to a further elaboration of the invention, in opened condition of the shut-off valve, the circulation in both circulation circuits

WO 2005/082499

PCT/NL2005/000098

5

mentioned is such that the pressure drop is substantially equal over the whole surface of the filter material.

According to a further elaboration of the invention, more than one permeate circulation circuit can be provided for forming a corresponding
5 number of back pulse pressure areas on the permeate side of the filter housing. This has the advantage that, in the part in the filter where more pollution occurs, back pulsing can, for instance, take place more often and/or using more volume and/or counterpressure. This has the advantage that, with severely polluting areas, the cleaning can be carried out more
10 thoroughly and/or more regularly than in areas where the pollution is only limited.

It will be clear that the retentate circulation circuit is also connected to a retentate discharge pipe.

According to a further elaboration of the invention, it is particularly
15 favorable when the frequency at which the shut-off valve is operable is in the range of 1-1000 Hertz. At such a frequency, an excellent selectivity can be preserved as well as an improvement of the capacity of the apparatus. Viewed in time, the shut-off valve may, for instance, be closed 2-50% and opened 50-98%.

According to a further elaboration of the invention, the shut-off valve
20 may comprise a valve housing in which a rotating camshaft is arranged, while the cam of the camshaft forms a closure in a certain range of rotational positions and allows a free passage of permeate in other positions, the camshaft being continuously drivable. Such a shut-off valve has a
25 simple construction. Preferably, the rotational speed of the camshaft is controllable for controlling the back-pulse frequency.

The invention further relates to a method for operating an apparatus according to the invention, where, in the filter housing, periodically at a high frequency, a higher pressure is built up on the permeate side than on
30 the retentate side, such that a reversal of the fluid flow in the filter material

WO 2005/082499

PCT/NL2005/000098

6

occurs, while, for the rest, a reversal of flow direction of fluid volumes in pipes of the apparatus is prevented.

According to a further elaboration of the method according to the invention, in both the retentate and the permeate side of the filter housing,
5 a cross-flow can be maintained for a further improvement of the flux and the selectivity of the filter material and for maintaining a substantially equal pressure drop over the whole surface of the filter material.

The invention will now be explained on the basis of two exemplary embodiments with reference to the drawing, in which:

10 Fig. 1 shows a first exemplary embodiment of the apparatus according to the invention;

Fig. 2 shows a second exemplary embodiment; and

Fig. 3 shows a third exemplary embodiment.

The Figures all shows an exemplary embodiment of the apparatus
15 where the filter housing is designated by 1. In the filter housing, filter material 2 is included which is usually designed as a filter membrane in practice. The filter membrane 2 divides the filter housing into a retentate side 3 and a permeate side 4. To the retentate side 3, a fluid supply pipe 5 is connected. To the permeate side 4, a fluid discharge pipe 6 is connected. In
20 the permeate discharge pipe 6, near the filter housing 1, a shut-off valve 7 operable at a high frequency is included. Further, a permeate circulation circuit is provided which comprises a circulation pipe 8. The permeate circulation pipe 8 is connected, by an inlet, to the permeate discharge pipe 6 at a point downstream of the shut-off valve 7. An outlet of the permeate
25 circulation pipe 8 is connected to the permeate side of the filter housing 1. In the permeate circulation pipe 8, a permeate circulation pump 9 is provided. Downstream of the pump 9 and upstream of the outlet 10, a restriction 11 is included in order to prevent jerky pressure build-up. Further, in the permeate circulation pipe 8, a permeate buffer tank 12 is
30 included for feeding the permeate circulation pump 9 during the closed

WO 2005/082499

PCT/NL2005/000098

7

position of the shut-off valve 7. The fluid supply pipe 5 is connected to a first end 15 of the retentate side 3 of the filter housing 1. Further, a retentate circulation circuit is provided of which the inlet 12 is connected to a second end 16 of the retentate side 3 of the filter housing 1. An outlet 13 of the retentate circulation circuit is connected to the fluid supply pipe 5. In the retentate circulation circuit, which comprises a retentate circulation pipe 14, a retentate circulation pump 17 is provided. The first end 15 is opposite the second end 16, such that, with a switched-on retentate circulation pump 17, a cross-flow along the filter membrane 2 occurs. The outlet 10 of the permeate circulation circuit 8 is connected to a first end 18 of the permeate side of the filter housing 1. The permeate discharge pipe 6 is connected to a second end 19 of the permeate side 4 of the filter housing 1. The first end 18 is opposite the second end 19, such that, on the permeate side of the filter housing 1, a cross-flow along the filter material 2 occurs. The cross-flow on the retentate side 3 has the same flow direction as the cross-flow on the permeate side 4. Here, the permeate circulation pump 9 and the retentate circulation pump 17 are preferably controlled such that, in opened condition of the shut-off valve 7, the circulation in both circulation circuits is such that the pressure drop is substantially equal over the whole surface of the filter material 2. To the retentate circulation circuit 14, further, a retentate discharge pipe 20 is connected for discharging the retentate not recirculated via the recirculation pipe 14.

The shut-off valve 7 is provided with a valve housing in which a rotating camshaft 21 is arranged. A cam 22 on the camshaft 21 forms a closure in a certain range of rotational positions and allows a free passage of permeate in the other positions. Preferably, the camshaft 21 is continuously drivable and the rotational speed of the camshaft 21 is controllable for controlling the back-pulse frequency.

With the exemplary embodiment shown in Fig. 1, in the filter housing 1, periodically at a high frequency, a higher pressure can be built

WO 2005/082499

PCT/NL2005/000098

8

up on the permeate side than on the retentate side, such that a reversal of the fluid flow in the filter material 2 occurs and where, for the rest, a reversal of the flow direction of fluid volumes in the pipes of the apparatus is prevented. The result of all this is that a very high back-pulse frequency can be used. By combining this high back-pulse frequency with a cross-flow on both the permeate side 4 and the retentate side 3, an excellent cleaning of the filter material or the filter membrane 2 is obtained without the capacity of the apparatus being reduced considerably as a result of the back pulsing. The selectivity and the flux remain high and the process can be continued for a prolonged time.

The exemplary embodiments of Figs. 2 and 3 differ from the exemplary embodiment of Fig. 1 in that three permeate circulation circuits 8, 8', 8" are present. Each permeate circulation circuit can be provided with its own pump 9, 9', 9" as shown. Each permeate circulation pump 9, 9', 9" then produces its own back-pulse pressure. However, it is also possible that only one pump is provided for all permeate circulation circuits and that the back-pulse pressures in the different circuits differ from one another in that, in each permeate circulation circuit, a different restriction 11, 11', 11" is included.

In the exemplary embodiment of Fig. 2, dotted lines indicate that, downstream of the permeate circulation pumps 9, 9', 9", short-circuit pipes are connected, which are each, by an outlet, connected to the permeate discharge pipe 6 downstream of the shut-off valve 7. In each of these short-circuit pipes, a shut-off valve 7', 7" needs to be present that is normally closed but that can be opened when the shut-off valve 7 is closed to prevent the back pulse of the respective permeate circulation circuit. In this manner, the frequency of the back pulsing can be varied per permeate circulation circuit. For this purpose, the shut-off valves 7', 7" can be designed as pulsing shut-off valves.

WO 2005/082499

PCT/NL2005/000098

9

In the exemplary embodiment of Fig. 3, the permeate side 4 of the filter housing 1 is divided into three compartments 4, 4', 4". To each compartment 4, 4', 4", a permeate circulation pump 8, 8', 8" is connected at an upstream end of the compartment 4, 4', 4". Further, to each

5 compartment 4, 4', 4", a discharge pipe 6, 6', 6" is connected at a downstream end of the compartment. In each discharge pipe 6, 6', 6", a pulsing shut-off valve 7, 7', 7" is included for creating back-pulse behavior specific to the respective compartment. The shut-off valves 7, 7', 7" can be designed in the manner as described with reference to the first exemplary

10 embodiment. Both for the exemplary embodiment of Fig. 2 and that of Fig. 3, it holds true that the (pulsing) shut-off valves 7, 7', 7" can be synchronized, for instance in that one camshaft is provided which bears a cam for each shut-off valve. In this context, synchronizing is to be understood in a broad sense, in the sense that the opening and closing of the

15 various shut-off valves are geared to one another.

It is clear that the invention is not limited to the exemplary embodiment described but that various modifications are possible within the framework of the invention as defined by the claims.

DEC 16 2008

WO 2005/082499

PCT/NL2005/000098

10

CLAIMS

1. An apparatus provided with a micro or ultrafiltration filter, wherein the filter is provided with a filter housing (1) having a retentate side (3) and a permeate side (4), wherein the retentate side and the permeate side are separated from each other by filter material (2), wherein a fluid supply
5 pipe (5) is connected to the retentate side (3) and a permeate discharge pipe (6) to the permeate side (4), wherein, in the permeate discharge pipe (6), a shut-off valve (7) operable at a high frequency is provided and wherein means (8-11) are connected to the permeate side (4) for increasing the pressure in the permeate side (4) when the said shut-off valve (7) is
10 closed to a value which is higher than the pressure on the retentate side (3).
2. An apparatus according to claim 1, wherein the shut-off valve (7) is designed to be opened and closed periodically, wherein the shut-off valve (7) is kept in a closed position so long that a higher pressure is built up on the permeate side (4) than on the retentate side (3), such that a reversal of the
15 fluid flow in the filter material (2) occurs, wherein the means (8-11) for increasing the pressure in the permeate side (4) are designed such that, for the rest, a reversal of flow direction of fluid volumes in pipes of the apparatus is prevented.
3. An apparatus according to claim 1 or 2, wherein the means (8-11) for
20 increasing the pressure comprise at least one permeate circulation circuit (8) which is, on the one side, connected, by an inlet, to the permeate discharge pipe (6) at a point downstream of the shut-off valve (7) and, on the other side, by an outlet (10), to the permeate side (4) of the filter housing (1), wherein a permeate circulation pump (9) is provided in the permeate
25 circulation circuit.
4. An apparatus according to claim 3, wherein, upstream of the outlet (10) of the permeate circulation circuit (18) and downstream of the

WO 2005/082499

PCT/NL2005/000098

11

pump (9), a restriction (11) is included in order to prevent a jerky pressure build-up.

5. An apparatus according to claim 3 or 4, wherein, in the permeate circulation circuit (8), a permeate buffer tank (12) is provided for feeding the permeate circulation pump (9) during the closed condition of the shut-off valve (7).

6. An apparatus according to any one of the preceding claims, wherein the fluid supply pipe (5) is connected to a first end (15) of the retentate side (3) of the filter housing (1), wherein a retentate circulation circuit (14) is provided, wherein an inlet (12) of the retentate circulation circuit (14) is connected to a second end (16) of the retentate side (3) of the filter housing (1), wherein an outlet (13) of the retentate circulation circuit (14) is connected to the fluid supply pipe (5), wherein a retentate circulation pump (17) is provided in the retentate circulation circuit (14), wherein the first end (15) is opposite the second end (16), such that, with a switched-on retentate circulation pump (17), a cross-flow along the filter material (2) occurs.

7. An apparatus according to claim 6, wherein the outlet (10) of the permeate circulation circuit is connected to a first end (18) of the permeate side (4) of the filter housing (1), wherein the permeate discharge pipe (6) is connected to a second end (19) of the permeate side (4) of the filter housing (1), wherein the first end (18) is opposite the second end (19), such that, on the permeate side (4) of the filter housing (1), a cross-flow along the filter material (2) occurs, wherein the cross-flow on the retentate side (3) has the same flow direction as the cross-flow on the permeate side (4).

8. An apparatus according to claim 7, wherein, in opened condition of the said shut-off valve (7), the circulation in both said circulation circuits (8, 14) is such that the pressure drop is substantially equal over the whole surface of the filter material (2).

WO 2005/082499

PCT/NL2005/000098

12

9. An apparatus according to claim 3, wherein more than one permeate circulation circuit is provided for forming a corresponding number of back pulse pressure areas on the permeate side (4) of the filter housing (1).
10. An apparatus according to any one of the preceding claims, wherein, to the retentate circulation circuit (14), a retentate discharge pipe (20) is connected.
11. An apparatus according to any one of the preceding claims, wherein the frequency at which the shut-off valve is operable is in the range of 1 to 1000 Hz.
- 10 12. An apparatus according to any one of the preceding claims, wherein, in a period comprising the opened and the closed position, the shut-off valve (7) is in an opened position for 50-98% of that period and is in the closed position for 2-50% of that period.
- 15 13. An apparatus according to any one of the preceding claims, wherein the shut-off valve comprises a valve housing in which a rotating camshaft is arranged, wherein the cam of the camshaft forms a closure in a certain range of rotational positions and allows a free passage of permeate in other positions, wherein the camshaft is continuously drivable.
- 20 14. An apparatus according to claim 13, wherein the rotational speed of the camshaft is controllable for controlling the back-pulse frequency.
15. A method for operating an apparatus according to any one of the preceding claims, wherein, in the filter housing, periodically at high frequency, a higher pressure is built up on the permeate side than on the retentate side, such that a reversal of the fluid flow in the filter material occurs, wherein, for the rest, a reversal of flow direction of fluid volumes in pipes is prevented.
- 25 16. A method according to claim 15, wherein on both the retentate and the permeate side of the filter housing, a cross-flow is maintained.

SUBSTITUTE SHEET (RULE 26)

WO 2005/082499

PCT/NL2005/000098

1/3

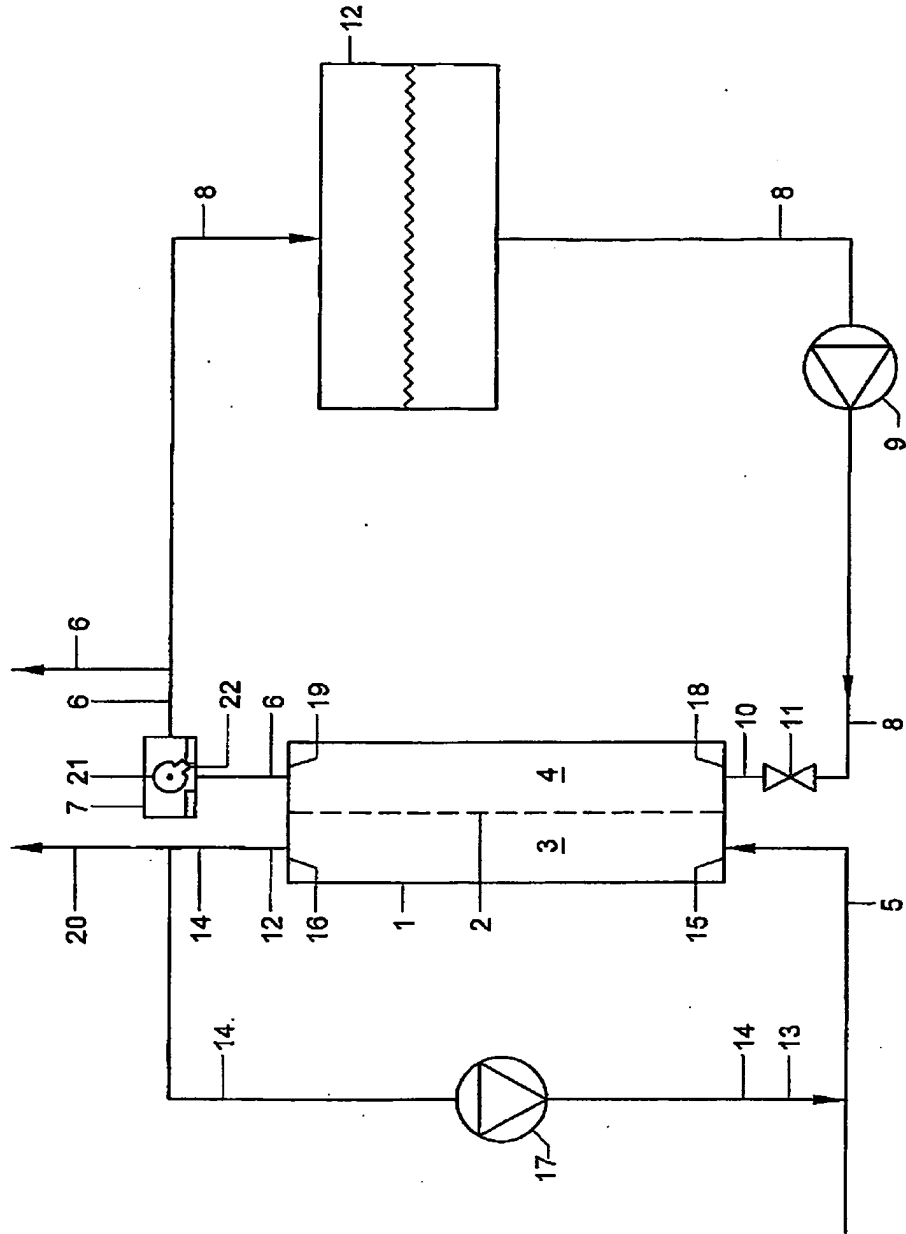


Fig. 1

WO 2005/082499

PCT/NL2005/000098

2/3

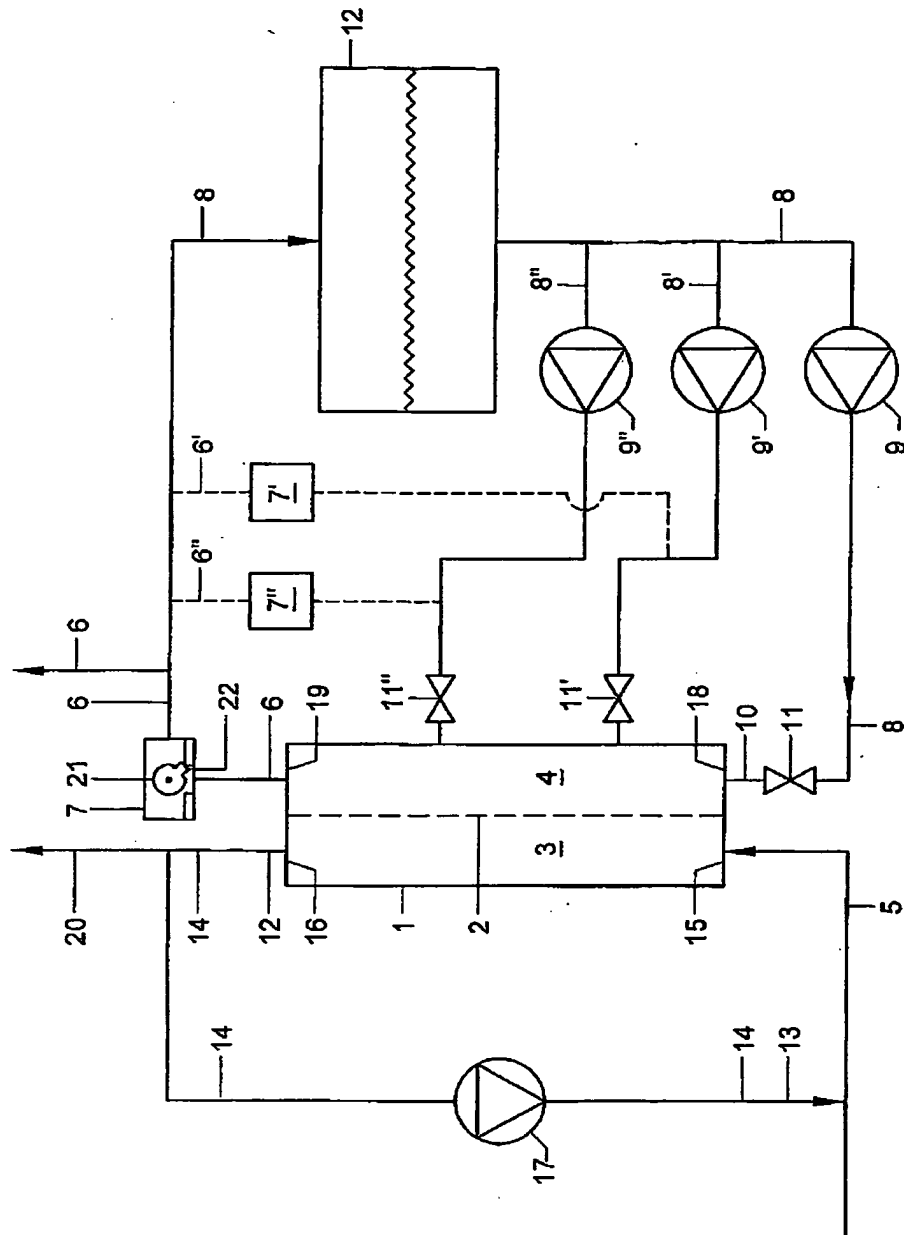


Fig. 2

WO 2005/082499

PCT/NL2005/000098

3/3

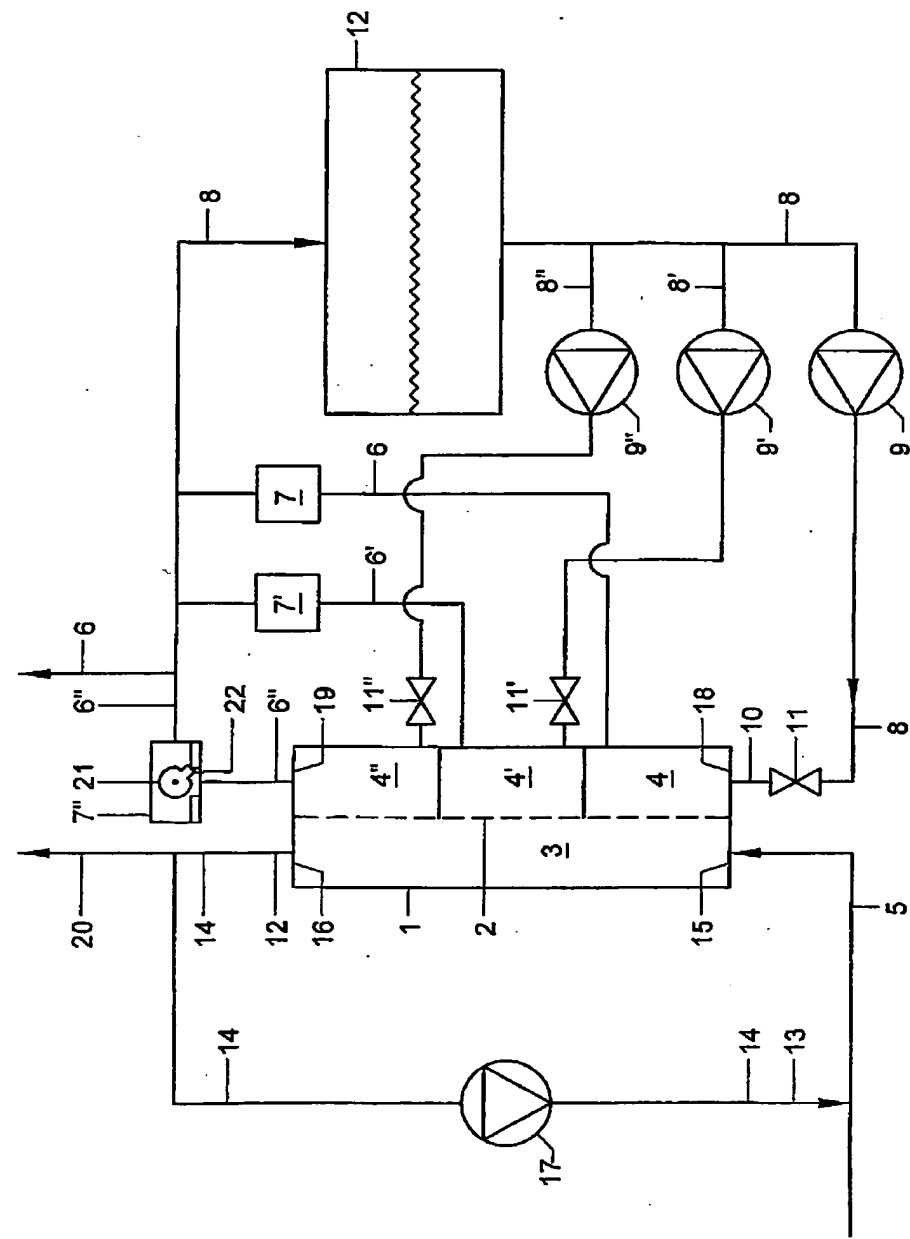


Fig. 3

INTERNATIONAL SEARCH REPORT

Int'l Application No
PCT/NL2005/000098

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B01D65/02 B01D65/08 B01D61/14 B01D63/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 102 24 513 A (TUCHENHAGEN GMBH) 11 December 2003 (2003-12-11) the whole document	1,11
A		2,15
X	NL 1 020 180 C (AQUAMARIJN HOLDING B V) 16 September 2003 (2003-09-16) the whole document	1,11
A		2,15
X	EP 1 043 053 A (VITO) 11 October 2000 (2000-10-11) the whole document	1
A		2,15
	-/-	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- *A* document member of the same patent family

Date of the actual completion of the international search

9 May 2005

Date of mailing of the international search report

17/05/2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2260 HV Rijswijk
Tel (+31-70) 340-2040, Tx 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Hilt, D

Form PCT/ISA/210 (second sheet) (January 2004)

page 1 of 2

INTERNATIONAL SEARCH REPORT

 Inter Application No
 PCT/NL2005/000098

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 586 202 A (MERIDIONAL OENOLOGIE CENTRE) 20 February 1987 (1987-02-20) the whole document	1,6,10
A		2,15
A	WO 01/10540 A (HANSEN PREBEN BOEJE ; JENSEN JENS PETER (DK); MOELLER HANNE ELLEN (DK)) 15 February 2001 (2001-02-15) figures 1-5,16,28 page 1, line 1 - page 5, line 3 page 6, line 9 - line 14 page 8, line 15 - line 26 page 35, line 19 - line 23	1,3,5-8, 10-12, 15,16
A	EP 0 595 689 A (COMMISSARIAT ENERGIE ATOMIQUE) 4 May 1994 (1994-05-04) the whole document	1,3,6-8, 10,15
A	US 2003/132175 A1 (WILLIAMS JASON ET AL) 17 July 2003 (2003-07-17) the whole document	1,6,10, 15
A	EP 0 588 348 A (NIHON MILLIPORE KOGYO KK) 23 March 1994 (1994-03-23) cited in the application the whole document	1,15

Form PCT/ISA/210 (transmission of search report) (November 2004)

INTERNATIONAL SEARCH REPORT

 International Application No.
 PCT/NL2005/000098

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 10224513	A	11-12-2003	DE 10224513 A1	11-12-2003
NL 1020180	C	16-09-2003	NL 1020180 C1	16-09-2003
EP 1043053	A	11-10-2000	EP 1043053 A1	11-10-2000
FR 2586202	A	20-02-1987	FR 2586202 A1	20-02-1987
WO 0110540	A	15-02-2001	AU 6426800 A	05-03-2001
			BR 0012993 A	18-06-2002
			CA 2378335 A1	15-02-2001
			WO 0110540 A2	15-02-2001
			EP 1229996 A2	14-08-2002
			JP 2003506206 T	18-02-2003
EP 0595689	A	04-05-1994	FR 2697172 A1	29-04-1994
			EP 0595689 A1	04-05-1994
			JP 6198145 A	19-07-1994
US 2003132175	A1	17-07-2003	NONE	
EP 0588348	A	23-03-1994	JP 6094143 A	05-04-1994
			EP 0588348 A2	23-03-1994
			US 5354466 A	11-10-1994

Form PCT/ISA/210 (patent family annex) (January 2004)